What Are SPICE Data?

SPICE data tell you:

spacecraft ephemeris, planetary/satellite ephemeris and constants, instruments, C pointing matrix, event information (kernels)

- when an **instrument** was taking data

- how an instrument was acquiring data (operating mode)

- where the spacecraft was located

  operation
  orientation

- how the spacecraft and its instruments were oriented (pointed)

  location

- what was the location, size, shape and orientation of the target being observed

  ephemerides

- what other relevant events were occuring on the spacecraft or within the ground data system

  spacecraft clock sequence files

SPICE File Types

- Spacecraft/lander/rover ephemerides (position & velocity)   SPK

- Target body ephemerides   SPK

- Target body size/shape/orientation   PCK

- Instrument and other structures mounting alignment   FK

- Instrument field-of-view geometry and similar information   IK

- Spacecraft and other articulating structures orientation   CK

- Spacecraft clock correlation coefficients   SCLK
  Used for spacecraft clock time conversion

- Leapseconds   LSK
  Used for ephemeris time conversion

- Events (EK):

  - Science observation plans   ESP

  - Sequence (spacecraft and instrument commands)   ESQ

  - Experimenter's Notebook   ENB

- Star catalog   (coming soon)

SPICE Software

- Subroutines to write some kinds of SPICE files (SPK, CK, ESQ)

- Programs to write some kinds of SPICE files (SPK, ENB)

- Subroutines to read SPICE files (all types except ESP, ENB)

- Subroutines to compute parameters derived from SPICE kernels data
  - Examples: position, direction, lighting angles, LAT/LON, etc.

- Program for querying contents of EVENTS kernels (ESQ)

- Programs for utility and data management functions

  - Porting binary files between dissimilar CPUs (SPK, CK, ESQ)

  - Merging binary files (SPK, CK)

  - Summarizing contents/coverage (SPK, soon CK)

  - Annotating binary files with metadata (SPK, CK, ESQ)

  - Reading or extracting metadata from files (SPK, CK, ESQ)

Examples of What Can Be Computed
Using SPICE Data and Software

- Position, velocity, range, altitude, light-time

- Target body orientation

- Sub-spacecraft latitude and longitude

- Spacecraft or spacecraft structure orientation

- Instrument orientation ("look direction")

- Instrument "look direction" intercept location on a target

- Instrument field-of-view projection on a target

- Lighting angles (phase, incidence, emission) at a specified location

- Smear magnitude and orientation

SPICE File Availability

Spacecraft	Vehicle SPK	Target SPK	PcK	FK	IK	CK	SCLK	EK: ESP	EK: ESQ	EK: ENB	Other
Generic ephemerides:											
planets		•	•								
satellites		•	•								
comets and asteroids		•									
DSN antennas	•										
Mariner 9	•	•									
Mariner 10	•	•									
Pioneer 6, 8, 10, 11	•	•									
Viking Orbiter 1,2	•	•		•	•	•	•				•
Voyager 1,2	•	•			0	0	•			0	
Giotto, Vega	•	•									
Ulysses	•	•									
Magellan	•	•	•								
Phobos-2 (USSR)	•	•	•								
Clementine	•	•	•	•	•	•	•				•
Gallileo Cruise	•	•	•	•	•	•	•		•		
Gallileo Tour	•	•	•	•	•	•	•	•	•		
Galilleo Extended Mission	0	0	0	0	0	0	0	0	0		
Halca (VSOP Space VLBI, Japan)	•	•									
Mars Pathfinder Lander	•	•	•	•	•	•	•		•		
Mars Pathfinder Rover (Sojourner)	•	•	•	•	•	•	•				
Near Earth Asteroid Rendezvous	0	0	0	0	0	0	0				
Mars Global Surveyor (pre-mapping)	•	•	•	•	•	•	•			•	
Mars Global Surveyor (mapping)	0	0	0	0	0	0	0		0	0	
Mars Climate Orbiter	0	0	0	0	0	0	0		0	0	
Mars Polar Lander	0	0	0	0	0	0	0		0	0	
Stardust	•	•	•	•	•	•	•	0	0	0	
Deep Space 1	0	0	0	0	0	0	0	0	0	0	
Cassini cruise	0	0	0	0	0	0	0		0	0	
Cassini Saturn tour	0	0	0	0	0	0	0	0	0	0	
SIRTF	0	0		0	0	0	0				
Mars 01 Orbiter	0	0	0	0	0	0	0	0	0	0	
Mars 01 Lander	0	0	0	0	0	0	0	0	0	0	
Mars 01 Rover	0	0	0	0	0	0	0	0	0	0	
Genesis	0	0	0	0	0	0	0	0	0	0	
Mars 03	0	0	0	0	0	0	0	0	0	0	
Mars 05	0	0	0	0	0	0	0	0	0	0	
Mars Express (ESA)	*	*	*	*	*	*	*	*	*	*	
Contour	*	*	*	*	*	*	*				
Muses-CN (Japan)	*	*	*	*	*	*	*	*	*	*	
Deep Space 4	*	*	*	*	*	*	*	*	*	*	

• = full or partial   0 = expected in the future   * = future possibility